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(54) Method and device for detecting the loss-of-signal condition at the input of a transmission line interface

(57) A method of detecting the loss-of-signal (LOS) condition at the input of a transmission line interface when the input signal is coded. The input signal decoding includes an additional procedure allowing the detection of loss-of-signal condition. Since the pseudo-random sequence of the input signal transitions includes sequences of code violations, the additional procedure, over a certain threshold error rate, corresponding to a number of code violations in a unit of time, detects the loss-of-signal (LOS) condition.

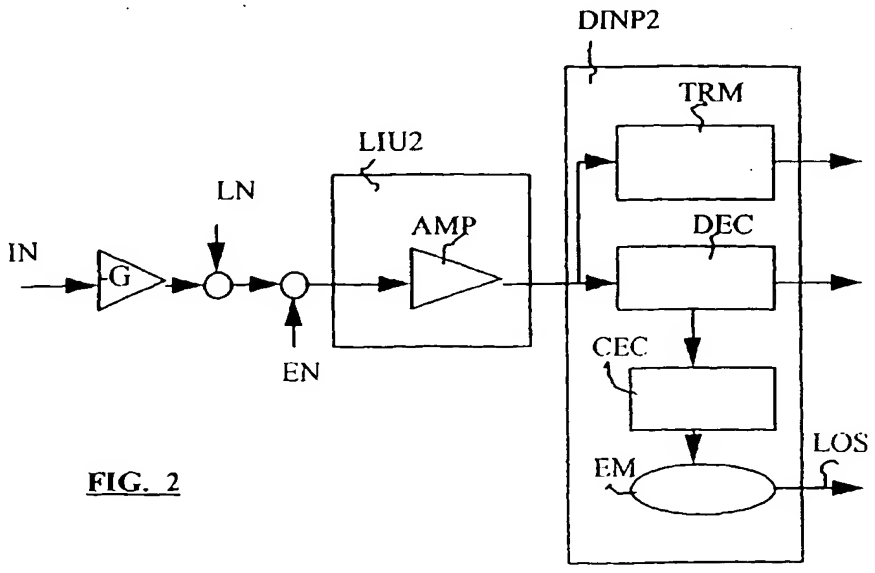

FIG. 2

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Description

[0001] The present invention relates to a method and device for detecting the loss-of-signal condition at the input of a transmission line interface, said input signal being a coded one and comprising pseudo-random sequences of signal transitions.

[0002] In on-line transmission systems, the hardware line interface unit (LIU) receiving signals from the lines (cable-type) can be too sensible and can locally regenerate a signal even in the absence of useful signal transitions on the line, especially when the signal on the line becomes too low, under a given threshold, or in the absence of signal because of, e.g., a break of the cable, since the high input sensitivity leads to an erroneous interpretation of the line and apparatus noise levels as useful signal, thus regenerating the input signal as a sequence of pseudo-random transitions.

[0003] Under these conditions, the detection of loss of input digital signal (LOS), which is normally present, becomes unreliable and LIU regenerates an erroneous signal mixed with noise.

[0004] In order to overcome this problem, various hardware arrangements, based on an input circuit which detects the signal level followed by a signal muting stage, are already known.

[0005] Normally, said additional circuit is bulky, expensive and further requires to redesign and replace the entire input printed circuit board (PCB) containing the line interface LIU for all the apparatuses already installed, should them be not provided with said function, and it was necessary to connect it afterwards.

[0006] Therefore, it is an object of the present invention to overcome the aforesaid drawbacks and to provide a method and device for detecting the loss-of-signal LOS condition at the input of a transmission line interface consisting in a very simple additional procedure to be inserted, during the decoding step, into the line interface when the input signal is coded. In fact, the decoder itself can be used as a loss-of-signal condition detector, since the pseudo random sequence of input signal transitions includes code violation sequences. The additional procedure over a certain threshold error rate, corresponding to a number of code violations per unit of time, detects the loss-of-signal, LOS, condition.

[0007] In order to achieve these objects, the present invention provides a method and device for detecting the loss-of-signal (LOS) condition at the input of a transmission line interface as best described below and claimed in the following claims, which are an integral part of the present description.

[0008] The method according to the invention has the basic advantage that it can be carried out by means of a software routine which can be easily inserted in all the already installed apparatuses having no hardware arrangements installed yet, instead of replacing the entire card. In fact it suffices to reprogram the program storage in any manner known per se.

[0009] Further objects and advantages of the present invention shall result in being clear from the following detailed description of an embodiment thereof and from the accompanying drawings which are attached merely by way of a non limiting example in which:

- Fig. 1 shows a functional block diagram of a known circuit;
- Fig. 2 shows a functional block diagram of the circuit according to the present invention.

[0010] As an example of a known loss-of-signal detecting circuit, in Fig. 1 an input signal IN is supposed to have a determined attenuation level - G and to be summed with line noise LN and noise EN introduced by the apparatus.

[0011] Said signal IN is applied to an input line interface LIU1 of an apparatus, consisting of an input amplifier AMP which is normally used for regenerating the signal and taking it up to a level enough to be applied to the following stages. When the input useful signal becomes too weak, the noise level at the input can be enough to make AMP regenerate the signal mixed with noise at its output.

[0012] This gives rise to the problem that in the following digital input interface DINP1, the normally existing circuit TRM, which detects the LOS condition as an absence of transitions of the signal itself, do wrong because detect transitions which are erroneously regenerated by AMP.

[0013] Therefore, an input level detecting circuit DET, for instance a peak-to-peak one, is inserted in the line interface LIU1 which, under a given threshold level, emits a muting signal of the AMP output signal.

[0014] DEC stands for a conventional decoding circuit of the input signal. Therefore, as depicted in Fig. 2, in accordance with the invention, a very simple method can be used for detecting the loss of input digital signal (LOS) when the input signal is coded, which replaces the operation of the detecting circuit DET.

[0015] Since the pseudo-random sequence of the input signal transitions includes code violation sequences, the decoder DINP2 can be used as a loss-of-signal condition detector, by carrying out a counting of the number of violations.

[0016] The decoder carries out an additional procedure whereby, over a certain threshold error rate corresponding to a number of code violations per unit of time, detects the loss-of-signal condition.

[0017] When the decoder includes an error detector, a code error counter CEC can be provided. Said counter can be already provided and forming part of the signal decoder.

[0018] Therefore, the EM procedure provides for counting the errors or reading out the counter when already provided, and for using the counting as a monitor of the attenuation level of signal coming from the line: under a certain attenuation level, equivalent to the over-

coming of a given threshold value in terms of error rate and therefore of counting on the counter, it detects the loss-of-signal (LOS) condition.

[0019] The counter integrates the counting over a given time interval and compares it with a threshold value in terms of number of errors (error rate).

[0020] As a non limiting example of a specific arrangement, a procedure has been developed in the case of a 2Mb/s HDB3 coded input signal.

[0021] The HDB3 decoder includes an error code counter CEC used for signal decoding, which counts the violations of the zero sequence coding rule (see ITU-T Recommendation G. 703, Annex A).

[0022] This counter is read and cleared at each time interval by the aforesaid procedure EM.

[0023] In accordance with the ITU-T Recommendation G. 775. a LOS threshold, ranging between 18 and 22 dB, of input signal attenuation is used, with 2^{15} errors per second detected.

[0024] The foregoing is believed sufficient for those skilled in the art to understand the invention. Modifications and variations will be readily apparent in light of this disclosure. The actual scope, however, is defined by the following claims.

Claims

1. Method of detecting the loss-of-signal (LOS) condition of a signal (IN) at the input of a transmission line interface (LIU), said input signal (IN) being a coded signal and comprising pseudo-random sequences of signal transitions, characterized in that it comprises, during the decoding step, the step of evaluating a number of code violations of said pseudo-random sequences of signal transitions per unit of time and declaring a loss-of-signal (LOS) condition if said number of code violations overcomes a given threshold value.

2. Method of detecting the loss-of-signal (LOS) condition according to claim 1, characterized in that said decoding step comprises counting a number of decoding errors, said step of evaluating a number of code violations being said counting of a number of decoding errors.

3. Device for detecting the loss-of-signal (LOS) condition of a signal (IN) at the input of a transmission line interface (LIU), said input signal (IN) being a coded signal and comprising pseudo-random sequences of signal transitions, characterized in that it comprises means (CEC, EM) for evaluating a number of code violations of said pseudo-random sequences of signal transitions per unit of time, said means declaring a loss-of-signal (LOS) condition if said number of code violations overcomes a given threshold value.

4. Device for detecting the loss-of-signal (LOS) condition according to claim 3, characterized in that said means (CEC, EM) comprise means (CEC) for counting the number of decoding errors and processing means (EM) which integrates said counting over a unit of time and which detects the loss-of-signal (LOS) condition if said counting overcomes a given threshold value.

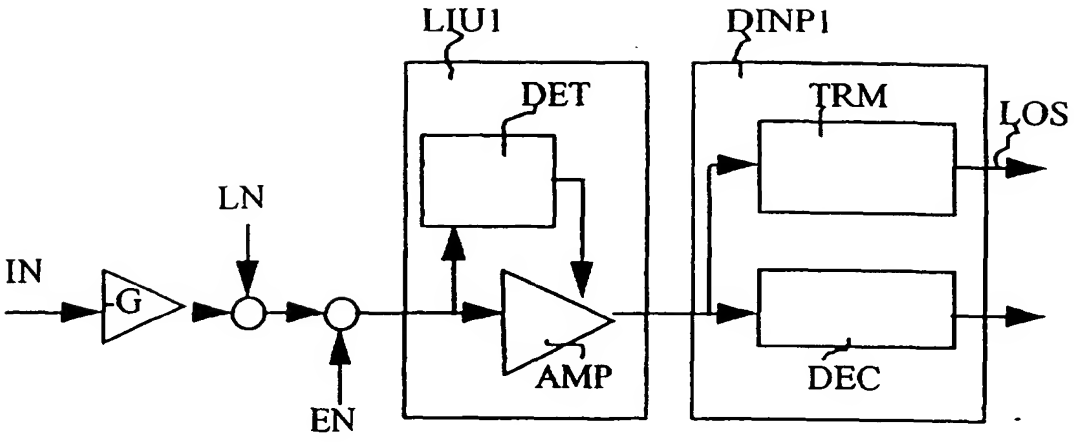

FIG. 1

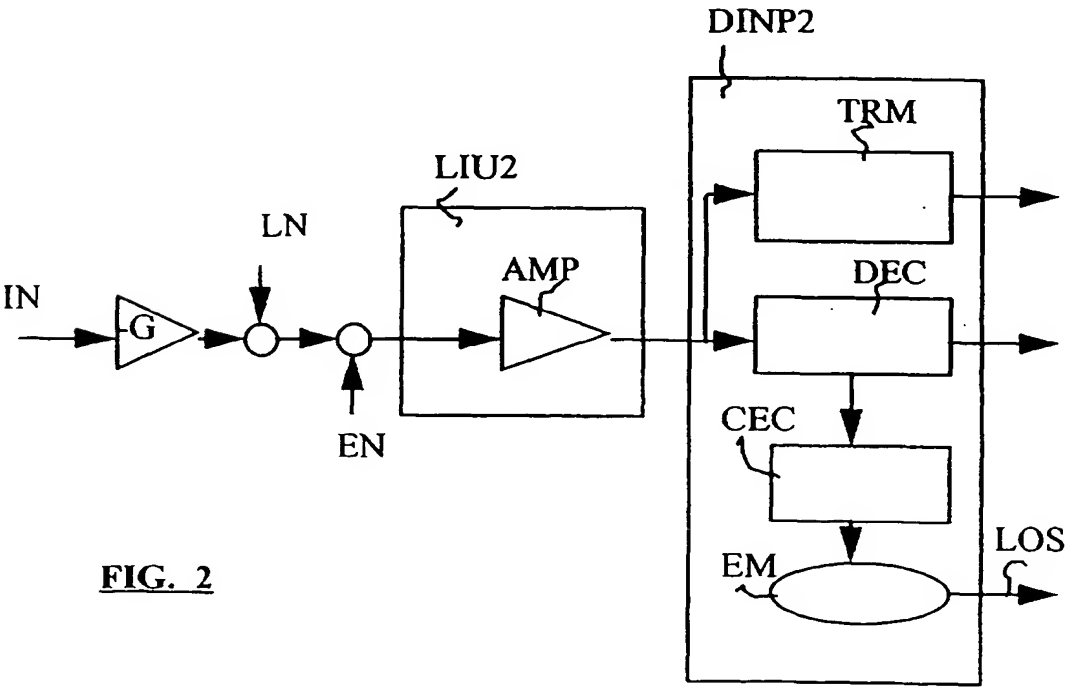

FIG. 2

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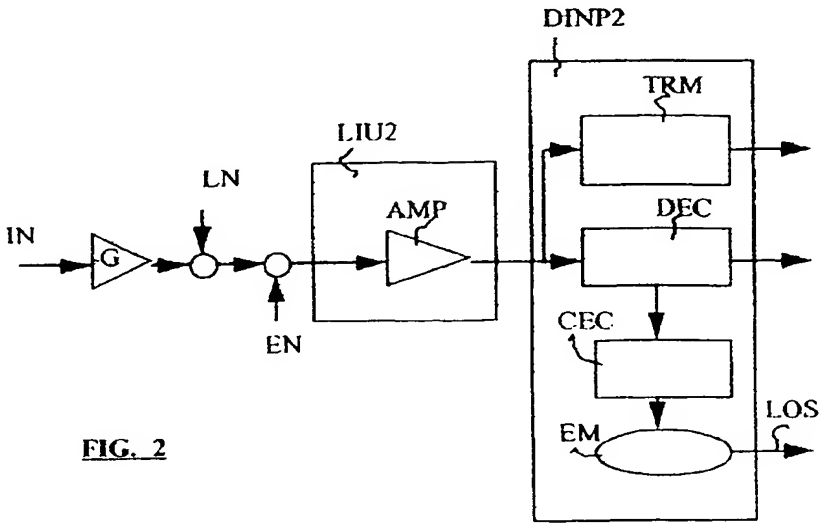

FIG. 2

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EUROPEAN SEARCH REPORT

Application Number
EP 98 44 0290

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X	US 5 673 132 A (MIRACLE GERALD HOLT ET AL) 30 September 1997 (1997-09-30) * column 4, line 6 - line 12 * * column 6, line 32 - line 54 *	1-4	H04L1/00 H04L1/24 H04L9/08
A	EP 0 671 827 A (FUJITSU LTD) 13 September 1995 (1995-09-13) * column 15, line 23 - column 16, line 24; figures 6-8 *	1-4	

TECHNICAL FIELDS SEARCHED (Int.Cl.6)

H04L
H03M
H04B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
BERLIN	9 May 2001	Masche, C

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 98 44 0290

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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09-05-2001

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